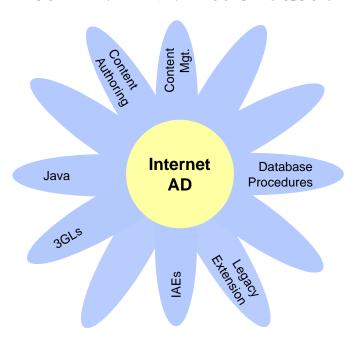
- 1. How will Internet/intranet applications development (AD) evolve to support e-business computing platforms over the next five years?
- 2. How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?
- 3. What skills and roles will be needed to develop and maintain Internet applications during the next five years?

#### Internet AD: A Market or Just a Mess?

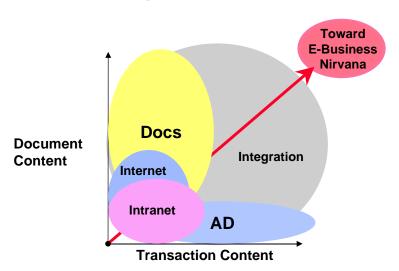


Source: GartnerGroup

As Internet and intranet developers continue to create applications that are focused on Web interaction, the need to use tools across many different categories of product grows ever more vital. Unfortunately, the proliferation of products that claim to be Internet AD products is growing, it seems, by the month. In fact, most AD tools and products can be used to produce Web-based front ends. However, not all products are equally as adept at providing Internet capabilities. To date, most client/server solutions based on two-tier architectures have been limited in scalability and generally unable to address the higher-end transaction processing (OLTP) required of typical enterprise class systems. Similarly, first-generation Web solutions based on simple CGI interfaces have lacked the sophistication necessary to address the complexity needed to integrate Web-based systems into enterprises' current IT infrastructures. Today, however, n-tier service-oriented architectures are emerging to enable client/server systems to scale to true OLTP performance levels. These architectures leverage a consistent "business object tier" and provide services to both the traditional rich GUI (e.g., Win32) interfaces as well as the customer-facing Internet/intranet clients (e.g., HTML) that are critical to new e-business initiatives. Action Item: Enterprises should leverage emerging AD technologies and methodologies that integrally leverage elements of OLTP, client/server and Web-based development. Increasingly, no single approach will be sufficient to address the requirements of new AD efforts during the next five years.

How will Internet/intranet applications development evolve to support e-business computing platforms over the next five years?

# The Web: Where Document Management Meets AD



Successful Business Applications Require Mastery of Both Dimensions

Source: GartnerGroup

Through 2004, over half of enterprises that do not adopt new content management techniques will suffer e-business-related business losses significantly greater than the cost of implementing such systems (0.7 probability).

Both the document management and application development aspects of site creation and operation will require synchronization with each other and with the analysis of customer behavior to manage in the e-business environment. The content created, the transactions themselves, etc. must be synced so a full picture of the customer interaction is available.

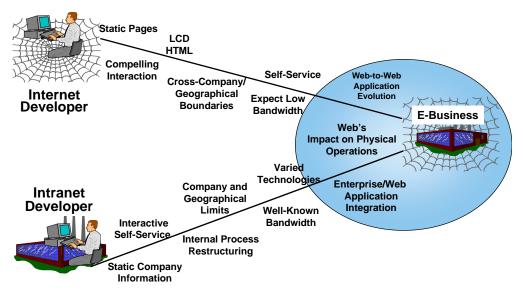
Similar to application development, common management frameworks and metadata must be created. Bugs will be critical, and as complexity increases, increasingly expensive to fix. As with document management systems, users will not all be technical and training must be inexpensive and universally accessible.

Management of business legal, ethical and security exposures will require that changes to pages, documents and programs/objects will need to be versioned, deployed, archived and recovered.

Action Item: Create a schedule to introduce change management systems in step with increasingly complex online business transactions.

Through 2004, Internet and Intranet AD efforts will converge in focus as the need to support ebusiness operations simultaneously for both internal and external users in better than 90 percent of projects (0.7 probability).

## Internet vs. Intranet AD: A Matter of Focus



Source: GartnerGroup

## Key Issue: How will Internet/intranet applications development evolve to support e-business computing platforms over the next five years?

Internet and intranet developers share common tools but have differing viewpoints on developing applications. Internet developers are typically more interested in developing compelling, content-oriented sites that must take into account the varied nature, location and capabilities of public Internet users. On the other hand, intranet developers have the luxury of being able to take advantage of more-advanced features of development tools due to their more-controlled environments and company-oriented projects. Technologies like ActiveX, large Java applications and synchronous connections can be used in high bandwidth environments where the network and desktop systems are under the control of IT. However, once the Internet is taken into account, developers must often resort to least-common-denominator technologies in order to reach the widest audience. As e-business becomes a mainstream part of a business' priorities, these two styles of development will begin to come together. The needs of e-business require that internal and external customer and partner relationships begin to merge and the need to integrate systems for both user bases becomes critical.

Action Item: Design applications in the belief that barriers between internal and external user needs will break down as networked business relationships are increased in importance.

By 2003, 40 percent of developers will have failed to implement business transformation (Level 4) capabilities into their applications due to the lack of sufficient features in their chosen AD tool sets (0.8 probability).

## Internet: A Framework for Strategic Web Sites

	vveb	LEVEL 4 Business Transformation				
		LEVEL 3 Business Integration	• Supplier Integration			
LEVEL 1 Basic	Prospecting	• E-Commerce • Transactions	<ul><li>Customer Integration</li><li>Personalization</li></ul>			
Presence	ADD'L FEATURES     Extensive	<ul><li>Communities</li><li>Customer</li></ul>	Multichannel     Integration			
• Company Information • Brochures	Information • Search Engine • Basic Interactivity	Self-Service • Basic Customization	<ul><li>Advanced Customization</li><li>&amp; Configuration</li></ul>			
<b>COST</b> \$30K-\$300K	со <b>s</b> т \$100К-\$900К	со <b>s</b> т \$1М-\$10М	со <b>s</b> т \$2М-\$80М			
PLACEHOLDER IN CYBERSPACE	CHANNEL EXPLORATION	CHANNEL DEVELOPMENT	CHANNEL EXPLOITATION			

Source: GartnerGroup

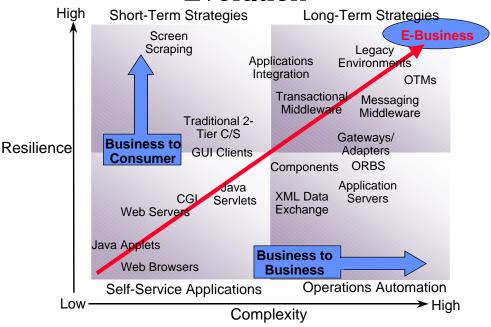
Key Issue: How will Internet/intranet applications development evolve to support e-business computing platforms over the next five years?

The GartnerGroup framework categorizes an enterprise Web presence according to four levels, each one a step up in functionality, cost and strategic importance. Level 1 is basic brochureware, while Level 4 requires an advanced stage of integration with both internal and external information infrastructures and value chains. Level 1 is a simple extension of the marketing communications department, while Level 4 requires significant reorganization of the enterprise to take advantage of the Web channel in areas such as customer service, fulfillment, procurement, business intelligence and strategic partnerships. Level 1 represents a simple one-way conversion of information from print collateral to HTML equivalent, while Level 4 goes beyond the Web to two-way integration of all the channels (Web, telephone, fax, pager, brick-and-mortar store) by which the enterprise reaches its customers, suppliers and partners. Level 4 cannot happen in a vacuum; a Level 4 site exists in an ecosystem that includes not just the enterprise but also the IT infrastructure for the industry in which the enterprise functions. Successful integration with suppliers, customers and partners requires a minimum IT infrastructure that varies by segment. Sectors such as financial services and electronics will lead, while others such as healthcare will lag.

Action Item: Select tools today that support integration facilities or servers.

Enterprises that integrate business-to-business and business-to-consumer technology infrastructures by year-end 2002 will gain a 25 percent to 50 percent competitive advantage over enterprises that manage the technologies separately (0.7 probability).

#### Global E-Business Infrastructure Evolution



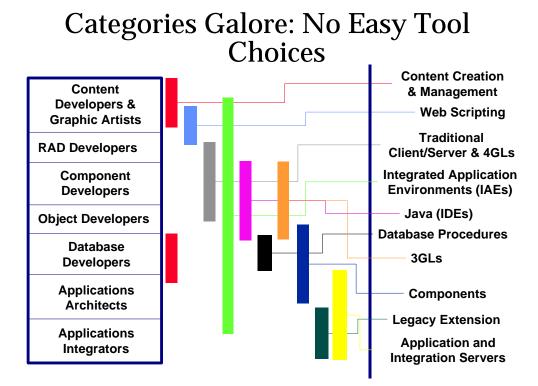
Source: GartnerGroup

## Key Issue: How will Internet/intranet applications development evolve to support e-business computing platforms over the next five years?

E-business strategies come in many "flavors," depending on the overall business objective, the industry and the enterprise's position within the industry or trading community. However, e-business deployment generally follows two defined paths: 1) business-to-consumer (B2C), focused primarily on top-line revenue generation and 2) business-to-business (B2B), focused primarily on operational efficiencies. Both directions began in simple Web publishing, with complex process support following later as e-commerce was achieved. Much of the technology and infrastructure required for B2B and B2C e-commerce can be shared, greatly reducing the complexity of managing multiple, overlapping e-commerce infrastructure. Moreover, many of an enterprise's strategic objectives are similar for B2C and B2B undertakings. Key objectives are to: 1) promote brand identity and loyalty among known and unknown customers; 2) identify and build a relationship with groups of customers and business partners through personalized presentation of specific products and services; 3) provide robust, reliable, fast and secure Web interaction; and 4) gain detailed information about customers and business partners.

Action Item: Enterprises must consolidate the technology infrastructure and operational responsibility for both B2B and B2C e-business direction under common organizational groups to ensure the proper context of applications architecture with business process architecture.

How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

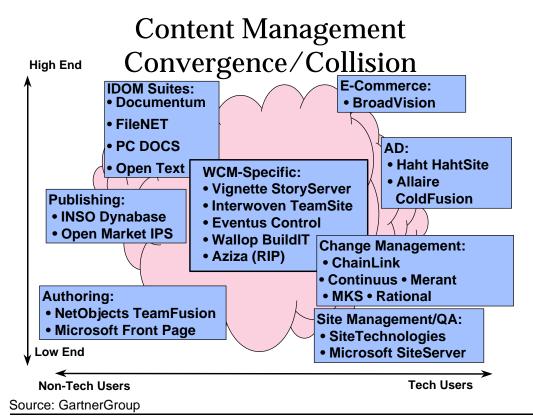


Source: GartnerGroup

Internet AD can no longer be considered a specific category of development when considering tools. The vast majority of tools today can be used to create Web-based content or a Web-based front end. While this provides basic Web support, it does not guarantee production of effective Web applications. Using traditional client/server tools to accomplish Internet AD, for example, leads to fatter client applications or less-manageable server components. As the Web becomes more popular, the number and types of developers are increasing. From content developers to applications architects, development requires mastery of tools that provide a wide range of Web-related functionality. Increasingly, the need for multiple toolsets includes the need for functions that go beyond transactional data and into unstructured content. Developers will also need to recognize when a project is in need of a particular toolset that must integrate with other tools and data. The movement to integrated application environments and application servers makes clear the need for integration to become a primary function of an AD shop.

By 2H02, the market for middle- and high-end configuration/content management (C/CM) products will be consolidated through a series of acquisitions by established AD and document management vendors (0.8 probability).

By 2H01, true C/CM products will appear out of the profusion of change-management, content-creation and content-providing vendors (0.8 probability).



Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

Vendors that see the pain enterprises are going through with managing content and components on Web sites, and the emerging WCM opportunity, have entered this category with a range of products. This includes both WCM-specific startup companies as well as vendors with established products in related areas such as software configuration management, electronic publishing and AD. A third vendor class is the large player with a broad multisegment product line addressing WCM problems by expanding the feature set of a more general product or suite (e.g., Microsoft SiteServer 3.0). Products derived from established offerings in related fields have the advantage of building from an in-depth understanding of a particular problem area, such as change management, and the disadvantage of limited understanding of Web-specific problems. Products from startup vendors have been better matched to WCM needs, but increasingly complex requirements will eliminate entrants that not have the resources to support enterprise needs. Action Item: Assess requirements in Web content and component management, and see how they align with your chosen vendor's experience. Balance your needs against the vendor's pedigree and strategy.

By 2004, scripting languages and markup languages will have displaced traditional languages for building client-side and Web server-side user interface functionality in better than 95 percent of new applications (0.8 probability).

# Web Scripting and Markup: Demystifying the Front End

Client Scripting		Server Scripting	
	JavaScript•		PERL•
VBA• XSL•		JSP•	<ul> <li>VBScript</li> </ul>
		VBA•	
<ul> <li>VBScript</li> </ul>	•ECMAScript	JavaScript •Tcl	• Python
	HTML•	CFML•	
XML•			•XML
DHTML*			
Client Markup		Server	Markup

Source: GartnerGroup

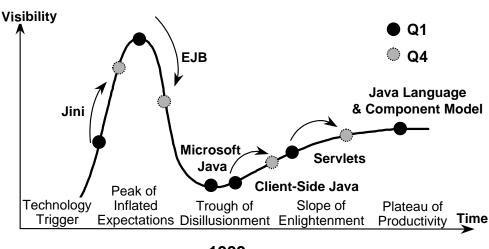
Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

The popularity of JavaScript as a client-side scripting language has left most other options for client-side logic seem wanting. However, a plethora of future options will likely change the landscape of client scripting as extensible markup language (XML) grows to dominance. The usage of XML on both the server as a markup language for describing data and its appropriateness as a markup language for page display means that it will be a strong competitor to hypertext markup language (HTML). On the server side, PERL still enjoys favored status among Web developers who write server-side programs. Although PERL is not as sophisticated as Java or as potentially pervasive as XML, it will continue to be a dominant means of writing simple server logic. The largest area of displacement for Web user interface generation is in the use of traditional languages such as Visual Basic or C. These languages will increasingly play a role in server business logic and will provide interface services to scripting environments. Java offers mechanisms for server-side generation of user interface such as Java servlets and the newly popular Java Server Pages (JSP).

Action Item: Use scripting languages in conjunction with HTML or provide a least-common-denominator client.

Java's transition to a mainstream AD platform has started but it will not have completed that transition until after 2001 (0.8 probability).

#### Java Enters the Mainstream



1999

Source: GartnerGroup

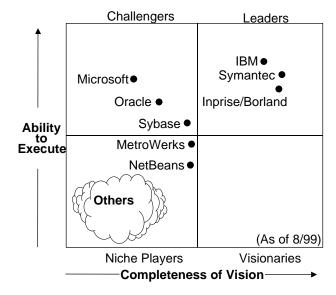
Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

1999 marks the beginning of Java's transition from an early-adopter Type A technology to one increasingly targeted by conservative organizations for mission-critical IT challenges. In 1998, many AD organizations debated: "Should we adopt and leverage Java for our IT efforts?" A year later, many of these AD organizations are now asking: "How and where should we adopt Java technology in our IT efforts?" This shift can be attributed to the maturity of Java tools and technology to a point where many organizations now assume that Java is more than a passing fad and will play a role in strategic IT efforts over the next five years. This view is particularly prevalent within AD organizations and vendors focusing on Internet and network-centric architectures. Today the common issue is *how* Java should be implemented rather than *if* it should be implemented. Java's transition to a mainstream AD platform has started but will not be completed during the course of 1999, and the Java platform will not completely emerge from the hype cycle before 2001 (0.8 probability). This will be most troublesome for conservative organizations as many attempt to adopt Java technologies for the first time. In 1999, Type A organizations have begun to see "real world" benefits from their early adoption efforts.

Action Item: Clients must move from experimentation to actual project production and should begin to seek ROI for Java work.

By 2001, 80 percent of Java integrated development environments (IDEs) will become integrated application environments (IAEs), while the remaining IDEs will either become integrated into an IAE or fall to niche status (0.9 probability).

#### Representative Java IDE Vendors



Source: GartnerGroup

Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

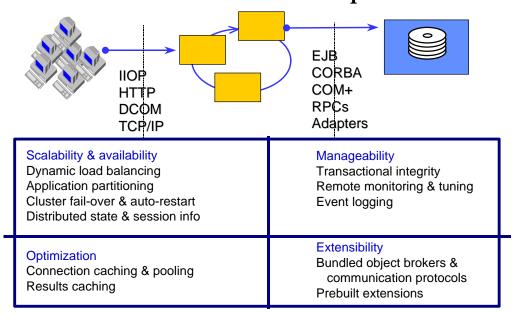
Java IDEs are focused on language-specific coding or on RAD support for building business applications. This market is consolidating to a point where the leading vendors are unlikely to change, barring acquisition or merger. Although there are many emerging and unknown IDEs, it is unlikely that any one of them will ascend to the position of leadership without some type of partnership. IBM has taken a lead primarily due to the fact that Inprise and Symantec are still working through organizational changes and revenue shortfalls. IBM is able to promote VisualAge for Java at a loss due to its expanded offerings.

Representative Vendors: Leaders - IBM, Symantec, Inprise. Challengers - Microsoft, Oracle, Sybase. Visionaries - None. Niche Players - Metrowerks, NetBeans.

Action Item: Developers should avoid multiple IDEs in favor of a single IDE for Java development. Even after acquiring an IAE, the IDE should still be considered an essential part of the developer's workbench.

The use of an application server enables development of a more-reusable, more-flexible and more-scalable business application.

# Application Servers: A Foundation for a Three-Tier Enterprise

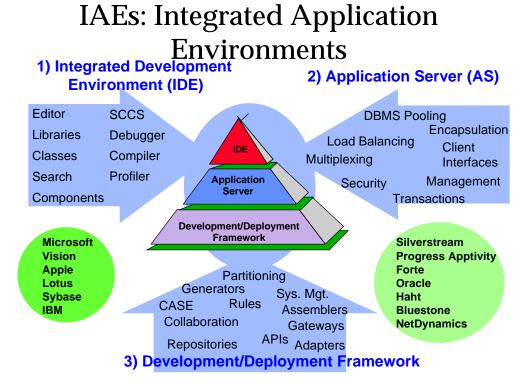


Source: GartnerGroup

## Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

Application servers (including TP monitors, OTMs, ORBs and Web application servers) are the essential foundation for a three-tier application topology. An application server improves scalability of the application platform by adding such features as load balancing, DBMS connection pooling, client connection pooling, fault tolerance and clustering, and dynamic directory services. Application servers also add other fundamental capabilities to the environment: distributed transaction management, security services, gateways to outside applications (legacy, packages), entry points for different client technologies, business logic encapsulation, support of components and objects, and persistence. Fundamentally, an application server hosts the business logic of the application and offers that logic (in the form of components, functions, services and message interfaces) to qualified requestors. The most basic application servers (RPC) simply provide entry points to the business functions. More-advanced application servers provide availability to the business functionality of the application despite hardware and software failures (fault tolerance), and increasing volume of concurrent requests (load balancing, multiplexing).

By 2004, IAEs will be used in up to 90 percent of opportunistic applications projects and for better than 50 percent of systematic projects (0.7 probability).



Source: GartnerGroup

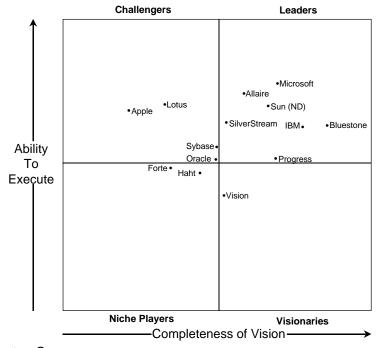
## Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

Integrated application environments are designed to provide end-to-end development features. They are in essence a combination of an integrated development environment, an application server, and a framework for developing and deploying applications. This contrasts with standalone IDEs or application servers in that the framework provides a consistent model for writing program code and deploying that code. Some IAEs are less capable than others. It is not necessary to have best of breed IDE, app server or framework. However, the best IAEs will have robust versions of each core mechanism. IAEs may be opportunistic or systematic. The opportunistic IAEs align almost perfectly with opportunistic application servers revealing a need for productive development environments built into a standard application server platform. IAEs can be used for both simple and complex projects although they are generally used (due to their immaturity) in relatively simple projects. Long-time vendors of IAEs in the Enterprise class space include Forte, and Oracle (Developer). The proprietary nature of an IAE's framework can be seen as both good and bad depending on developer need.

Action Item: Developers should seek out IAEs but must select stand alone IDEs and stand alone application servers to achieve breed performance and flexibility until 2002.

By 2004, vendors selling only an IDE or only an opportunistic application server will either consolidate their products into an IAE or will exit the market (0.7 probability).

### IAEs for the Opportunistic Market



Source: GartnerGroup

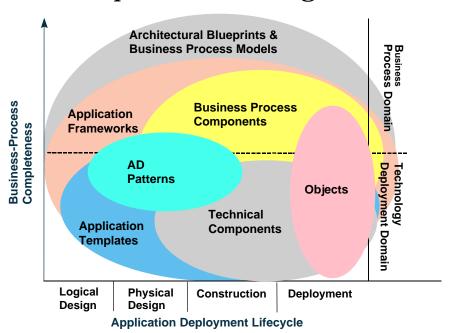
Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

Java AD tools can be split into two categories — IDEs and IAEs — which aligns well with the application server markets (both opportunistic and systematic). Java IDEs are focused on language-specific coding or on RAD support for building business applications. IAEs are end-to-end environments for building applets, server-side functionality and data access. Application servers service the middle-tier needs of business applications. The opportunistic market for IAEs is focused on building applications quickly with fewer skills but large functionality. These types of products are often not as resilient as the systematic products, but are available in larger numbers. The key component of an IAE is the application server, which represents the centerpiece of the applications architecture where business logic is handled. The vendors available on the systematic IAE chart are virtually the same as on the opportunistic chart, but they are positioned differently due to the focus of the market on high-end processing capabilities, resiliency of system operation and complexity of design. As these two markets converge (with some systematic vendors gaining opportunistic features), the focus on deployment complexity will still differentiate the products.

Action Item: Enterprises should select Java IDEs and IAEs that are associated with end-to-end development and the deployment capabilities usually delivered through an application server.

Components come in a variety of shapes and sizes and can reside in multiple technologies using different AD methods.

### **Component Building Blocks**



Source: GartnerGroup

### Key Issue: How will categories of Internet AD products influence the quest to develop Internet and intranet applications over the next five years?

The term "component-based development" (CBD) covers a wide variety of strategies, methods and technologies focused on reusing standard application "building blocks" (e.g., application templates, patterns and component libraries). Components can be described two ways. The first is from an OO context, where a component is simply a construct of multiple objects linked together with a common interface method that collectively represent a specific functional block. The second way that a component can be described is based on the fact that non-OO-based applications can be "componentized" using specific interface definitions. These non-OO applications and/or modules can be "wrappered" into components using a component model. The two dominant general-purpose component/programming models are Microsoft COM/DCOM and OMG JavaCORBA (Enterprise Java Beans). Other useful programming models include those defined for CICS and Tuxedo. Specific enterprise application vendors have implemented proprietary programming models (e.g., SAP ABAPI). The two component types can be deployed together using a common component model and associated programming model for defining the interfaces and subsequent behavior in interaction/collaboration between application components.

What skills and roles will be needed to develop and maintain Internet applications during the next five years?

#### Web Development: Traditional AD Altered for E-Business

	Traditional AD	Web Site AD
Methodology:	Single-path	Multipath
Design:	Coarse-grained	Fine-grained
Releases:	Infrequent	Frequent
Bugs:	Application critical widespread	User critical localized
Technology:	Homogeneous	Heterogeneous
Project Team:	Full-time, continuous assignments	Part-time, move frequently
Enhancements:	Infrequent, planned	Continuous, ad hoc
Dependencies:	Bidirectional	Unidirectional

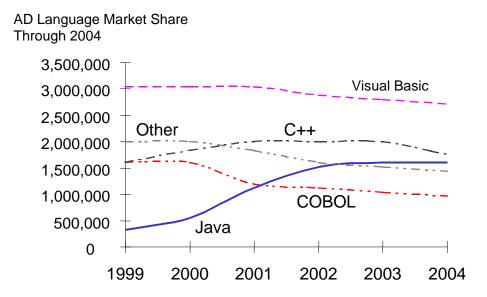
Source: GartnerGroup

In general, AD projects have a single main development path with a few minor tributaries; by contrast, Web site development (WSD) is almost all tributaries. AD projects are coarse-grained, with developers working for weeks or months. WSD projects are finer-grained, with a smaller staff working for days rather than weeks. Releases occur in AD at longer intervals (months and years), while WSD releases can be daily, if not hourly. AD projects cycle through stages (development, testing and maintenance) in a cohesive fashion, while WSD consists of many subprojects, each at its own stage in the life cycle and only loosely synchronized. AD bugs are often severe anomalies. WSD projects are usually less critical; many content bugs are benign and fixed easily. Many AD projects use mature technologies and can rely on a single language, tool and platform. WSD projects often have a heterogeneous staff, skills, tools and platforms, and must implement complex behaviors through an aggregation of HTML, scripts, Java, SQL plug-ins and image maps. Many Web sites find that a population of part-time contributors guided by in-house managers can produce more compelling and imaginative content over the long term compared to having resident artists and writers.

Action Item: Project managers should apply appropriate methods where WSD is different from traditional AD.

By 2002, 80 percent of new AD initiatives will be built with a combination of C++, Visual Basic, and Java language skills and technologies (0.7 probability).

#### 3GLs Going Strong



Source: GartnerGroup

### Key Issue: What skills and roles will be needed to develop and maintain Internet applications during the next five years?

GartnerGroup expects C++, Visual Basic and Java to garner the lion's share of the AD language demands through 2004. Most successful innovative initiatives will be based upon or be highly leveraged by one of these languages. For instance, Jini is an example of an innovative set of technologies built upon Java. The success of Java will mitigate many of the risks associated with new Jini-based efforts. Likewise, many XML-based e-business services are excellent examples of initiatives that can be heavily leveraged in combination with Java.

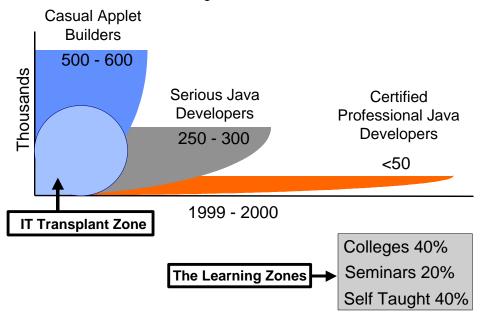
GartnerGroup believes that C++ will continue be heavily tied to CORBA as a well as to Microsoft COM. In addition, Visual Basic is expected to continue as language of choice for IT initiatives built upon and heavily leveraging Microsoft's technical architecture. Microsoft estimates that 80 percent of MTS (Microsoft Transaction Server) components developed today are built with Visual Basic.

Action Item: Enterprises should look to innovative technologies based on or leveraged by one of the more-prevalent AD languages (e.g., C++, Visual Basic or Java) to minimize risk and optimize ROI.

Despite IT advances, a reduction in developer competence due to an insufficient IT education will prevent an increase in the overall quality of applications through 2004 (0.7 probability).

Although most language growth is static, the number of professional Java developers will Increase from five percent of the total developers in the world to 20 percent through 2004 (0.7 probability).

### Java Skills Segmentation: Don't Believe Every Resume You Read



Source: GartnerGroup

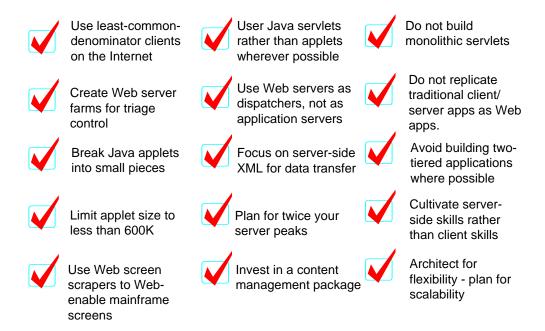
Key Issue: What skills and roles will be needed to develop and maintain Internet applications during the next five years?

Driven by an IT skill shortage, AD organizations are eagerly filling vacancies from a variety of non-IT sources. Unfortunately, many potential candidates from these sources lack the education, background and experience to deliver quality IT services. AD organizations will discover that over-reliance on these sources will deteriorate AD quality, decrease long-term viability of systems and raise the total cost of ownership (TCO) over an application's life cycle. To face the challenge, IS organizations must acquire and retain a mixture of specialists: migrants (i.e., "blue collar" IT construction resources) to Java as well as formally trained IT professionals with advanced computer science education (i.e., "white collar" IT engineers). Both groups will play a vital role in Java adoption. However, fledgling graduates are often let "loose" into the marketplace with an incomplete view of the requirements for IT development. As a result, graduates can write code, but are illequipped to design and architect systems. Consequently, Java developers are broken up into categories as in the figure above. The growth rate of non-professional Java programmers is currently highest, but overall, Java developer numbers are rising dramatically as opposed to other traditional programming languages.

Action Item: Clients must tailor training programs to enable graduates to mature their careers toward "professional" (i.e., managerial and technical team leadership) roles over time.

Develop a list of best practices for each category of tool used to build Web applications.

#### **Best Practices Checklist**



Source: GartnerGroup

## Key Issue: What skills and roles will be needed to develop and maintain Internet applications during the next five years?

Existing transactional applications will increasingly serve multiple user constituencies, characterized by different needs and attitudes. "Heads down" production workers will be flanked by occasional (internal and external) users as well as by knowledge workers who rely on information from multiple sources. Production users require efficient and responsive interfaces, whereas ease of use and quick deployment must be privileged to support occasional users. Knowledge workers instead want concurrent access to multiple applications and extensive integration (e.g., cut-and-paste) capabilities. Web technology is insuperable in terms of ease of deployment and the Web browser metaphor is intuitive and easy to learn, but it is still poorer than Windows GUI in term of performance and integrative features. The Web will complement, not replace, traditional interfaces to transactional applications. Enterprise middleware will continue to be a "necessary evil" aimed at adding multiplexing, security, reliability and integrity to basic Web protocols. As such, the middleware role will become more and more critical due to the extended interoperability needs induced by Web-based client access. *Action Item: Users should ensure that their Web plans take into consideration multiclient support capability as a key selection criteria*.

- Through 2004, over half of enterprises that do not adopt new content management techniques
  will suffer e-business-related business losses significantly greater than the cost of implementing
  such systems (0.7 probability).
- Through 2004, Internet and intranet AD efforts will converge in focus as the need to support ebusiness operations simultaneously for both internal and external users in better than 90 percent of projects (0.7 probability).
- By 2003, 40 percent of developers will have failed to implement business transformation (Level
  4) capabilities into their applications due to the lack of sufficient features in their chosen AD tool
  sets (0.8 probability).
- Enterprises that integrate business-to-business and business-to-consumer technology infrastructures by year-end 2002 will gain a 25 percent to 50 percent competitive advantage over enterprises that manage the technologies separately (0.7 probability).
- By 2H02, the market for middle- and high-end configuration/content management products will be consolidated through a series of acquisitions by established AD and document management vendors (0.8 probability).
- By 2H01, true C/CM products will appear out of the profusion of change-management, content-creation and content-providing vendors (0.8 probability).
- By 2004, scripting languages and markup languages will have displaced traditional languages for building client-side and Web server-side user interface functionality in better than 95 percent of new applications (0.8 probability).
- Java's transition to a mainstream AD platform has started but it will not have completed that transition until after 2001 (0.8 probability).
- By 2001, 80 percent of Java IDEs will become IAEs, while the remaining IDEs will either become
  integrated into an IAE or fall to niche status (0.9 probability).
- By 2004, IAEs will be used in up to 90 percent of opportunistic applications projects and for better than 50 percent of systematic projects (0.7 probability).
- By 2004, vendors selling only an IDE or only an opportunistic application server will either consolidate their products into an IAE or will exit the market (0.7 probability).
- By 2002, 80 percent of new AD initiatives will be built with a combination of C++, Visual Basic, and Java language skills and technologies (0.7 probability).
- Despite IT advances, a reduction in developer competence due to an insufficient IT education will prevent an increase in the overall quality of applications through 2004 (0.7 probability).
- Although most language growth is static, the number of professional Java developers will increase from five percent of the total developers in the world to 20 percent through 2004 (0.7 probability).